

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re Application of:	Nadeson et al.	Confirmation No.	9722
Serial No.:	10/574,438	Group Art Unit:	1614
Filing Date:	06/25/2007	Examiner:	Jagoe, Donna
Title:	METHODS AND COMPOSITIONS		

**DECLARATION OF COLIN GOODCHILD UNDER 37 C.F.R. § 1.132**

I, Colin Goodchild, hereby declare as follows:

1. I am an inventor on US Patent Application No. 10/574,438. I have been briefed by patent counsel in respect of the Office Action issued from the US Patent and Trademark Office on May 12, 2010. In the Official Action, the Examiner has alleged that the claims lack an inventive step in light of Nickel *et al.* (*Regional Anesthesia and Pain Medicine*, 18:4, 1993) and Grond *et al.* (*Pain* 79:15-20, 1999).

2. The following experiments were conducted by me, or under my supervision, and demonstrate the efficacy of treating neuropathic pain using a therapeutic combination of flupirtine and an opioid. Two animal models in which the animals have neuropathic pain were tested.

3. The first is the streptozotocin (STZ)-induced diabetic neuropathy model. In these experiments, rats were injected i.p. with STZ (150 mg/kg total dose) dissolved in 0.9% sodium chloride solution. The induction of diabetes was confirmed 1 week after injection of STZ by measurement of tail vein blood glucose levels. The rats were tested for hyperglycemia once per week to confirm continued high blood glucose readings.

4. Hyperalgesia was assessed using the paw pressure test. Paw pressure was measured using a Ugo Basile algometer (Apelex; probe 1mm, weight 10g). Increasing pressure was applied to the left hind paw until vocalization or sharp paw withdrawal was elicited. Paw withdrawal thresholds were measured for a group of weight matched controls and also in drug treatment groups of rats, 20 and 10 minutes before, immediately before (time 0), and also at 20, 30, and 40 minutes after i.p. injections of:

- saline (controls);
- flupirtine 5mg/kg;
- flupirtine 10 mg/kg;
- morphine 1.6 mg/kg;
- morphine 3.2 mg/kg;
- flupirtine 5 mg/kg plus morphine 3.2 mg/kg; or
- flupirtine 10 mg/kg plus morphine 1.6 mg/kg.

5. Tests took place 5 weeks after the first injection of STZ. Animals that had paw pressure nociceptive thresholds below 30 g (60% of the value of weight matched normal controls) were deemed to have developed hyperalgesia/neuropathic pain and thus used in further experiments.

6. In these studies, morphine when administered alone at a dose of 3.2 mg/kg resulted in no significant antinociception. However, a lower dose of morphine (1.6 mg/kg shown to be ineffective when administered alone) given in combination with flupirtine at 10 mg/kg caused highly significant antinociceptive effects causing complete reversal of hyperalgesia caused by diabetic neuropathy ( $P < 0.001$ , one-way analysis of variance). This combination of drugs was not sedating. As can be seen in Figure 1 (*attached*), the effects are not merely additive.

7. Male Wistar rats (HsdBrH Han WIST strain, 100-200g) were anaesthetized with halothane and syngeneic prostate cancer cells (AT3B-1 prostate cancer) were injected into the medullary cavity of the tibia. This led to an expanding tumor within the bone 2-3 weeks following injection. These changes were accompanied by the development of hyperalgesia to heat applied to the ipsilateral hind paw in 75% of rats treated.

8. The maximum non-sedating doses of morphine and flupirtine given alone and in a 4:1 dose combination were defined using open field activity monitor. Saline and gabapentin (100mg/kg i.p.) controls were also included in the studies. The rats were placed individually in an open field activity which is a darkened box in which the movement of the rat can be monitored remotely by the frequency and number of interruptions of infrared beam directed across the box in a grid. The activity of the monitor was measured for a period of 20 minutes in each rat after the administration of the drug(s) or saline control. If a rat was sedated by a drug treatment, the movements recorded would be less than the saline controls.

9. Paw withdrawal thresholds from noxious heat were measured. Dose response curves were plotted for morphine (0.312-10 mg/kg) and flupirtine (1.25-10 mg/kg i.p.) given alone and also for drugs given together in a 4:1 flupirtine:morphine fixed dose ratio combination (total dose 0.156-5 mg/kg i.p.). The responses were subjected to linear regression of log dose/response curves with subsequent isobolographic analysis.

10. The maximum non-sedating doses of morphine alone, flupirtine alone and 4:1 fixed dose ratio were 10, 8 and 4 mg flupirtine: 1mg morphine respectively. Non-sedating doses of both morphine ( $ED_{50} = 0.735$  mg/kg) and flupirtine ( $ED_{50} = 3.317$  mg/kg) as well as the fixed dose combination ( $ED_{50} = 0.39$  mg/kg) caused dose related antinociception (see Figure 2, *attached*). Isobolographic analysis revealed that there was a synergistic interaction between flupirtine and morphine (see Figure 3, *attached*).

11. Therefore, the data demonstrate that the same amount of analgesia could be achieved with a combination of flupirtine and morphine (4:1) as could be achieved using the drugs alone, but with 10% of the  $ED_{50}$  doses of each drug in the fixed dose combination. These results demonstrate that flupirtine in combination with an opioid allows a significant reduction in the amount of either drug administered alone in order to obtain an analgesic effect. Therefore, the use clinically of the combination of flupirtine and an opioid in the treatment of neuropathic pain provides enhanced therapeutic management of pain and disease and allows the administration of lower levels of drugs, thereby decreasing the associated side effects.

12. The results of these studies demonstrate that the analgesic effect of the combination of flupirtine and an opioid is synergistic when compared to the use of either compound alone.

13. The undersigned declares that all statements made herein of his own knowledge are true and that all statements made on information are believed to be true, and further that these statements were made with the knowledge that willful, false statements, and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Date: 27<sup>th</sup> May 2010

  
COLIN STANLEY GOODCHILD

**Figure 1: STZ-induced diabetic rat neuropathic pain model**

A combination of flupirtine and morphine, exhibits significantly greater antinociceptive effects without sedation than either drug alone. The combination of flupirtine and morphine also exhibits significantly greater antinociception without sedation when compared to the current clinical “gold standard” therapies, including gabapentin

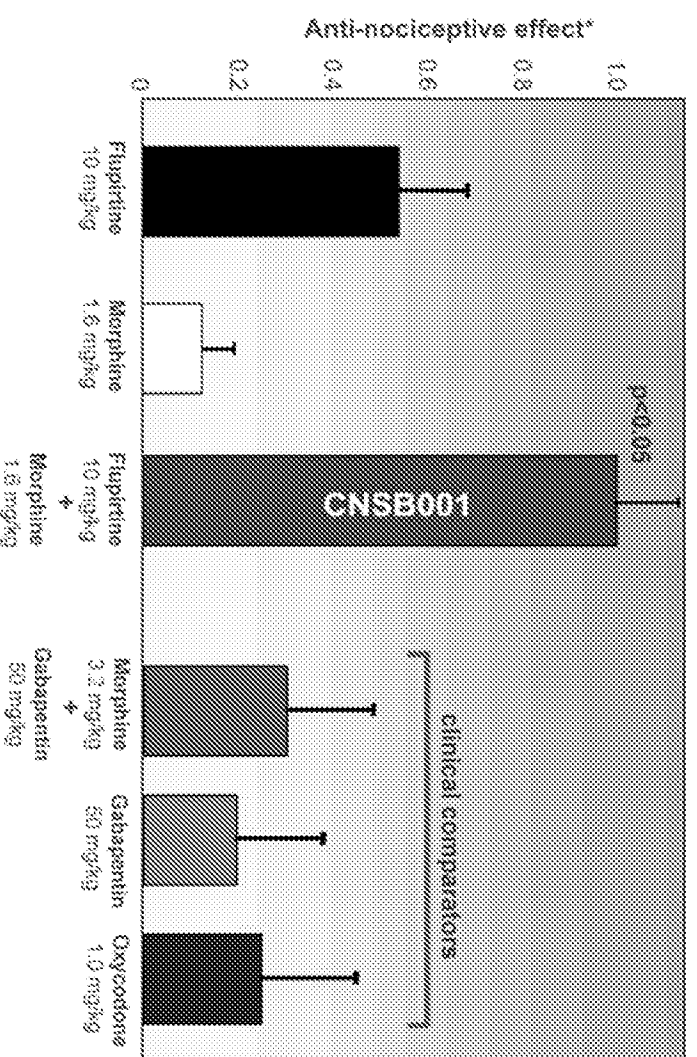


Figure 2: Rat bone cancer model

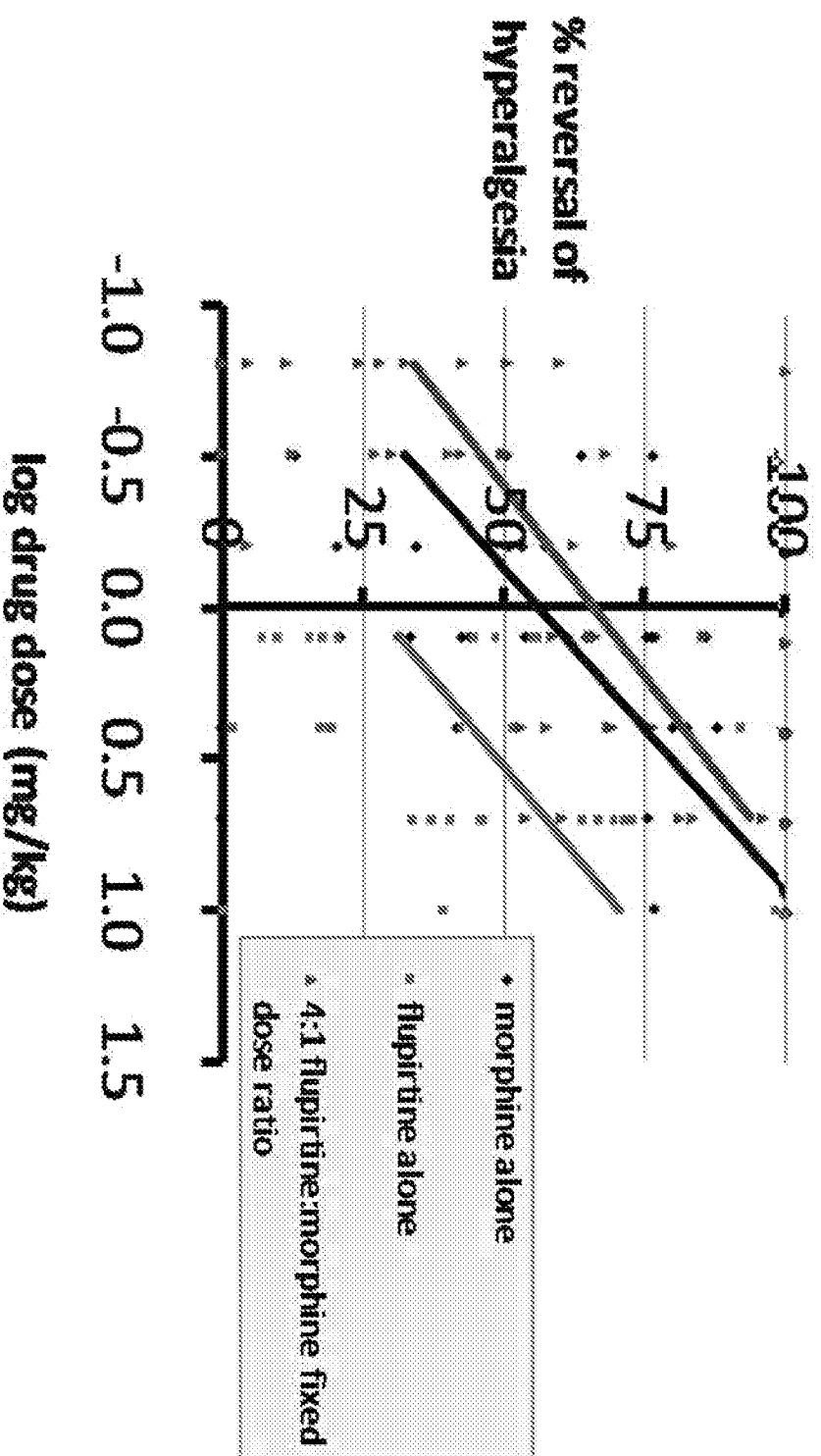
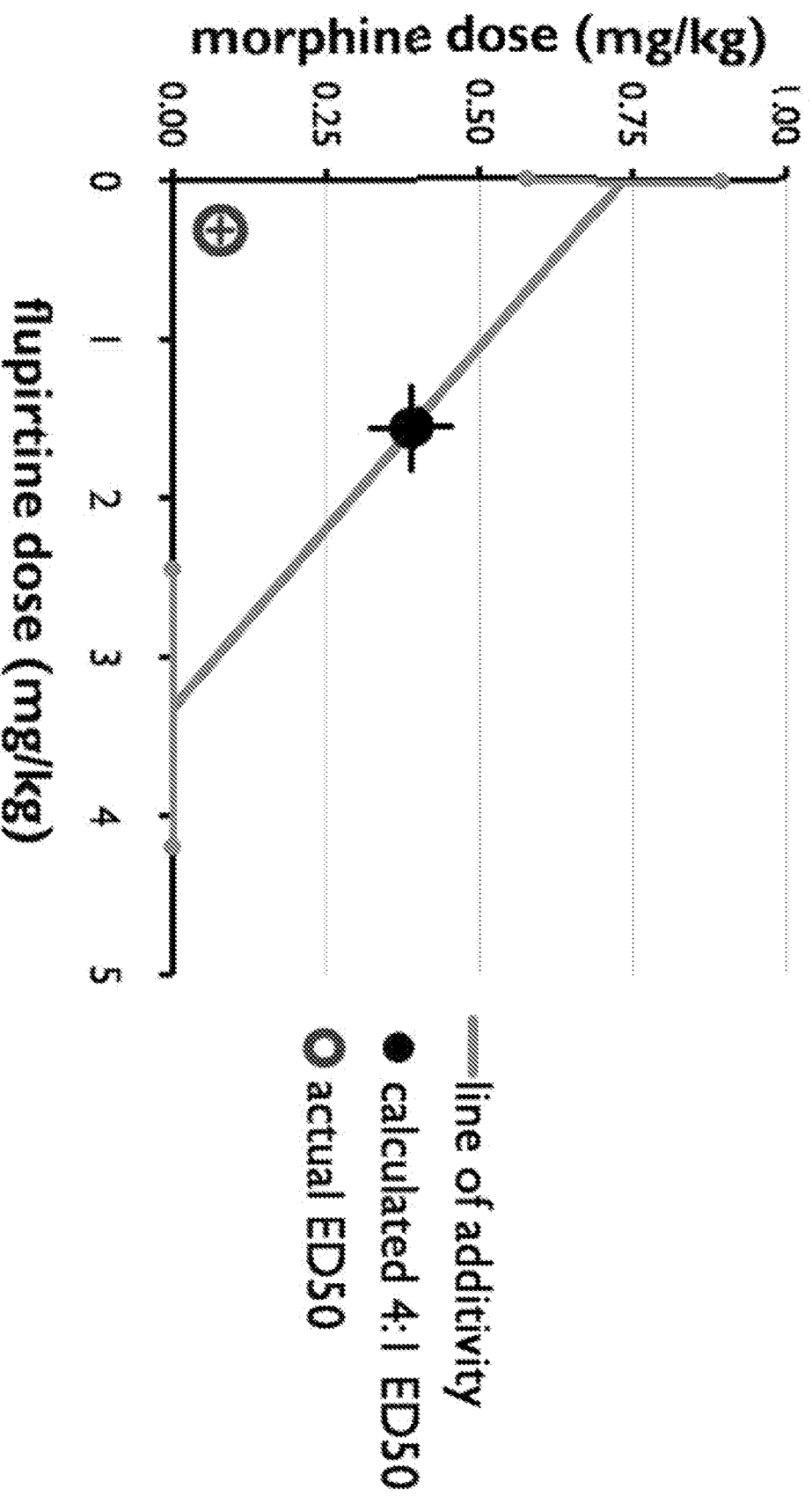


Figure 3: Rat bone cancer model



**COLIN STANLEY GOODCHILD**

MA., MB. BChir., PhD., FRCA., FANZCA., FFPMANZCA..  
Academic Specialist in Anaesthesia and Pain Medicine

### **Summary**

*The career details enclosed in this document show that I am a very experienced and qualified clinician in the fields of anaesthesia and pain medicine. I have practised in several countries in Europe and also in Australia. In addition I am a trained and qualified basic scientist. I have combined these skills and interests in developing an academic career pursuing neuroscience and clinical research side by side. I have written many papers, published in major international journals and have taught and presented my research all over the world. I have set up a new academic department and am thus no stranger to administration. I have experience of the pharmaceutical industry, at first with collaborative clinical research, but more recently with drug development. I have been successful in taking my intellectual property through development in the laboratory, proof of concept in humans and patenting. I have a blend of clinical and basic scientific skills and experience combined with good experience of clinical pharmacology.*

*Colin Goodchild*

*Saturday, 24 April 2004*

**DATE OF BIRTH** 8th May 1949

**NATIONALITY** British

**MARITAL STATUS** Married, 2 children

**PROVIDER NUMBER** 2032621T

**MEDICAL BOARD REG.** 26128 Victoria

#### **MEDICAL EDUCATION**

Pre-clinical: Kings' College, Cambridge 1967-1971

Clinical: St. George's Hospital,  
University of London 1971-1974

Academic Qualifications: M.A. (Cantab) December 1973  
M.B., B.Chir. June 1974  
F.R.C.A. (Eng) February 1978  
Ph.D. (University of Leeds) September 1984  
F.A.N.Z.C.A. 1994  
F.F.P.M.A.N.Z.C.A. 2000

Research Administration: National Health & Medical Research Council Aust. grant  
referee 1996-  
National Health & Medical Research Council N.Z. grant referee 1995-  
National Health & Medical Research Council Singapore 1999 -  
British Journal of Anaesthesia referee 1993 -  
Anesthesia and Analgesia referee 1999 -  
National Assessors Panel for Cancer Research Grants - 1995

Memberships: Australian Pain Society 1993 -  
International Association for the Study of Pain 1990-  
Anaesthetic Research Society (UK) 1985 -  
Australasian Society of Clinical for Experimental Pharmacology and  
Toxicology 1998 -  
Asean and Oceanic Society of Regional Anaesthesia 1999 -  
International Anesthesia Research Society 1999-  
European Academy of Anesthesiology (now EAA) 1995 -

#### **ACADEMIC APPOINTMENT**

January 1993  
Foundation Professor of Anaesthesia  
Monash University, Melbourne, Victoria

#### **OTHER APPOINTMENTS**

Senior Editor of the Journal "Pain Medicine"

Chief Scientific Officer CNSBio Pty Ltd

## HOSPITAL APPOINTMENTS

1993

Visiting Medical Officer, Southern Health Care Network

1993

Visiting Medical Officer, Peninsula Health Care Network

1996

Visiting Specialist, John Fawcner Hospital

February 1999

Visiting Specialist, Cabrini Hospital

March 2000

Visiting Specialist, Epworth Hospital

April 2000

Visiting Specialist, South Eastern Private Hospital

## PREVIOUS APPOINTMENTS

### Pre-registration:

July 1974 - January 1975

House Physician in General Medicine and Dermatology,  
St. George's Hospital, London.

February 1975 - August 1975

House Surgeon in General Surgery,  
Thanet District Hospital, Margate.

### Post-registration:

August 1975 - November 1976

Senior House Officer in Anaesthetics,  
St Mary's Hospital, Portsmouth.

November 1976 - March 1977

Senior House Officer in Anaesthetics,  
Southampton General Hospital.

April 1977-March 1979

Registrar in Anaesthetics,  
Southampton General Hospital.

April 1979 - March 1982

Wellcome Research Fellow,  
Department of Cardiovascular Studies,  
University of Leeds.

April 1982 - August 1982

Locum appointments, including four months

as Locum Anaesthetic Specialist in  
Eudokia Ziekenhuis, Rotterdam, The Netherlands.

September 1982 - January 1984  
Senior Registrar, Hammersmith Hospital and  
Honorary Tutor,  
Royal Postgraduate Medical School, London.

February 1984 to December 1992  
Senior Lecturer in Anaesthesia,  
University of Leeds,  
Honorary Consultant Anaesthetist,  
The General Infirmary at Leeds.

## CURRENT APPOINTMENT

### *academic*

I was appointed Foundation Professor in the new Monash University Department of Anaesthesia in 1992. I took up my appointment in Australia in January 1993. This is the first University Chair of Anaesthesia in the State of Victoria. I have built up the Department from scratch with the broad brief from the College of Anaesthetists, the Victorian Chairs of Anaesthesia Appeal and Monash University to increase the status and profile of academic anaesthesia in the State of Victoria. The major thrust of this work involves teaching and research as well as public relations. After my arrival I immediately began the task of getting the Department up and running with respect to administration. Having appointed a secretary and established the basic administrative bones of the Department I set about my main task, which was commissioning a basic research laboratory in order to continue my work, started in Leeds; basic scientific studies of antinociceptive mechanisms. I appointed a Research Fellow who has a PhD from Monash University Department of Pharmacology and we began work together on spinally administered analgesics in rats as I had done in Leeds. This field of endeavour has been very productive with many abstracts presented to national and international meetings and papers published in Journals such as Pain, Journal of Pharmacology and Experimental Therapeutics, Anesthesiology and British Journal of Anaesthesia. Most of the research in the Department has been based in this laboratory but some clinical research has been completed in Monash Medical Centre. Some of this such as studies in postoperative analgesia with dextromethorphan and the new local anaesthetic, ropivacaine were in close collaboration with pharmaceutical companies.

The Department is involved extensively in undergraduate as well as postgraduate teaching. This includes teaching of undergraduates in anaesthesia and postoperative pain relief during their 5th year, postgraduate anaesthetic lectures at Hospital and at College level as well as invited lectures in Melbourne as well as outside the City of Melbourne in the State of Victoria.

I have created further academic positions in the University Department at the level of lecturer. These individuals are anaesthetists in clinical training whom also research and study within the Department for the degree of PhD. At the end of their five-year appointment, the lecturers emerge fully qualified Consultant Anaesthetists with a basic science PhD training. Two have already done so with PhD training in basic science. Another fully qualified anaesthetist has finished study in the department and has been awarded the degree of PhD. Her studies involved molecular biology of GABA<sub>A</sub> receptors at the level of the spinal cord.

It can be seen that the University Department of Anaesthesia at Monash has basic science and teaching interests in the field of pain. I am very involved in the provision of the Acute Postoperative Pain Service at Monash Medical Centre and I have also helped set up a pain clinic in Southern Health which provides pain medicine services for patients with chronic non malignant pain and also cancer associated pain. In addition to being granted the Australian and New Zealand College of Anaesthetist diploma (ANZCA), I have been elected as a fellow to the newly formed Faculty of Pain Medicine (FFPMANZCA). My teaching and research interests span the full range encompassed by pain medicine: from molecular pharmacology of GABA<sub>A</sub> receptors involved in spinal cord pain processing; through studies in whole animals with acute and chronic pain models with analgesic drugs acting at the level of the spinal cord; to clinical work with patients suffering from acute and chronic pain states. This has been extended further in recent years with another lecturer whose research involves work on pain epidemiology. In particular we are looking at the effect on quality and type of acute pain management on subsequent incidence of chronic pain.

Grants and donations from the following sources have financed the work of the department:

- Australian and New Zealand College of Anaesthetists
- Australian Society of Anaesthetists
- National Health and Medical Research Council
- Southern HealthCare Network
- Tattersalls
- Harold and Cora Brennan Trust
- FH Faulding
- ICI
- Astra
- Zeneca
- Purdue Pharma

#### *Drug Discovery and Development*

Research on spinal cord GABA<sub>A</sub> receptors that began in Leeds in 1985 led to discovery of a number of subtypes of these receptors involved in spinal cord control of antinociception. I proved clinically with midazolam that drugs acting at these receptors could be very potent analgesics in humans. However midazolam had to be injected intrathecally, directly into the cerebrospinal fluid; this is invasive and a specialised treatment but it is useful and in regular clinical use in a number of places around the world. It occurred to me then that these GABA<sub>A</sub> receptors might be sufficiently different to be targeted selectively by compounds that would be novel analgesics. Preliminary experiments with water-soluble neurosteroids showed that this group of drugs could interact with spinal cord GABA<sub>A</sub> receptors to produce analgesia without sedation. I have since proved that orally administered neurosteroid can cause powerful antinociception by action at those spinal cord GABA<sub>A</sub> receptors. This action is so specific that the pain relieving effects are produced without effects on the brain such as sedation. This has been translated to humans; a drug taken orally potentiates opioid analgesics without increased sedation or nausea. This culminated in the patenting of neurosteroids for use as analgesics. I took the drug through the patenting process working directly with patent attorneys. I also organised meetings and negotiations to license the technology to an industry partner. The formal commercial development process of my intellectual property is now under way. I am still involved with the decision making process in that project. The latter has been an interesting and stimulating experience that has led to my interest in entering the drug development and commercialisation industry. I have come to realise that I have a unique blend and breadth of scientific, academic, clinical and administrative experience that combine well in this sort of activity.

#### *Clinical*

I maintain an active clinical anaesthetic involvement providing clinical anaesthesia for a total of two days and one night on call per week serving a variety of surgical specialties including general surgery, orthopaedics, thoracic surgery, urology, gynaecology and obstetrics and plastic surgery. I run the acute pain relief service in Monash Medical Centre where I am the main referral and information source for senior and junior doctors seeking help and information in the conduct of all aspects of pain medicine.

I have also been involved with the work of Monash Medical Centre therapeutics committee. I was its chairman for five years, and I oversaw its transition to the committee for all the hospitals in the Southern HealthCare Network. My standing in the profession often leads to me being asked for my professional opinion on the conduct of a patient's treatment for use in legal proceedings.

## CLINICAL EXPERIENCE

### *Pre-registration*

My first clinical appointment as House Physician in General Medicine was held at my teaching hospital, St. George's, Hyde Park Corner. I was responsible for patients under the care of Professor Domhorst and two dermatology teams.

### *General Professional Training*

I started my postgraduate education in anaesthetics in St. Mary's Hospital, Portsmouth, and after one year in this appointment I passed my Primary F.F.A. examination. I was trained to anaesthetize patients for a variety of surgical procedures, both elective and acute. I also became interested in local anaesthetic techniques, particularly epidural and spinal anaesthesia.

I was appointed Registrar in Anaesthesia at Southampton General Hospital in 1977. I added to my experience of anaesthesia for general, ENT, ophthalmic and gynaecological surgery and obstetrics. In addition I received training in anaesthesia for neurosurgery, cardiac and thoracic surgery and paediatric surgery. This was an excellent scheme for General Professional Training and I was successful at the Final F.F.A. examination in February 1978.

During my final year as a Registrar in Southampton General Hospital I gained further experience, performing many duties of the senior registrars. This included another training module of three months in cardiac and thoracic anaesthesia. This incorporated paediatric open and closed heart operations and thoracic surgical procedures such as pneumonectomy, lobectomy, thymectomy and surgery for pectus excavatum.

### *Higher Professional Training*

After my locum specialist appointment in anaesthesia in Rotterdam I was appointed Senior Registrar in Anaesthesia in the Hammersmith Hospital. There I gained further training in anaesthesia for many branches of surgery that included cardiothoracic (open and closed heart procedures in adult and paediatric patients as well as thoracotomy for lung surgery), major hepatobiliary surgery and intensive care. During this appointment I confined my activities to clinical duties and completion of my Ph.D. thesis. However, while working in the Hammersmith Hospital one could not fail to be attracted by the productive co-existence of clinical duties and research interests. I decided to return to academic activities after completing my higher professional training.

### *Clinical duties during previous appointment*

My previous appointment of Senior Lecturer in Anaesthesia in the University of Leeds carries an honorary consultant contract with the Leeds Western Health Authority. When I began this appointment I gave anaesthetics to patients on three surgical lists: two general surgical lists involving major colorectal surgery and one orthopaedic surgical list. I also took part in the general consultant on-call rota (one or two nights on-call per month, and one weekend every two months).

Many changes occurred after Professor McDowall's death in December 1984. Besides my own clinical commitments I managed some of Professor McDowall's clinical responsibilities; in particular, I gave anaesthetics for a whole day general surgical list. The responsible surgeon was Professor David Johnston and patients underwent major colorectal procedures including mucosal proctocolectomies (the surgery sometimes lasted up to 12 hours).

My clinical duties up to April 1991 were two all-day surgical lists:

- 1) With Professor David Johnston -general surgery;
- 2) a cardiothoracic surgery list.

These were both very heavy surgical lists lasting at least 8 hours each. A combination of these two commitments provided me with the best possible material to maintain my clinical skills.

Besides the general surgical procedures such as anterior resections, hemicolectomies and gastric surgery, I also gave anaesthesia for longer procedures such as the mucosal proctectomies with total colectomies. This involved a wide range of practical skills such as arterial and central venous catheterisation and regional anaesthesia: subarachnoid; epidurals both lumbar and thoracic. My cardiothoracic list involved adult open and closed heart operations and also thoracotomies for lung surgery.

It was and still is my practice to offer thoracic epidural analgesia to my patients undergoing major intra-abdominal and thoracic surgery. This technique provides postoperative analgesia using a mixture of epidural bupivacaine and opioid for a period up to 72 hours. I developed a technique for postoperative analgesia using intrathecal midazolam and diamorphine while working in Leeds. This development extended from my laboratory research. I have continued to use this method although the opioid has changed to morphine because of availability. I have taught and promulgated the technique for management of acute and chronic pain states (including cancer) for fifteen years. It is now used in many centres around the world. The method produces excellent analgesia without the side effects that we see with the epidural technique and thus is particularly suitable for sicker, high risk, patients.

## RESEARCH TRAINING AND EXPERIENCE

### *Studies for the Degree of Ph.D.*

After gaining my final F.F.A. one year into my Registrar appointment at Southampton, I became interested in making physiological measurements in patients under anaesthesia and in intensive care. It soon became obvious to me and to the Professor of Anaesthesia (Professor John Norman) that I needed proper training in research methods, philosophy and techniques. I joined the Department of Cardiovascular Studies in Leeds in 1979 as Wellcome Research Fellow for three years full-time research. During my three years in the Department of Cardiovascular Studies I carried out original research in cardiovascular physiology and neurophysiology under the guidance of Professor R.J.Linden and Dr Cecil Kidd (later Regius Professor of Physiology at the University of Aberdeen).

My Ph.D. thesis is entitled "The Brain Stem and Spinal Cord Pathways involved in the Left Atrial Stretch Reflex", and my Ph.D. project consisted of three separate studies.

a) The purpose of the first section was to determine the intraspinal distribution of neurones contributing impulses to the renal sympathetic nerves. The reason for this was to define the area of spinal cord that should be explored neurophysiologically for neurones responding to left atrial stretch receptor stimulation; stimulation of these receptors inhibits renal nerve activity. I made a detailed anatomical study of the sympathetic nervous system defining the intraspinal distribution of sympathetic preganglionic neurones and the intraspinal origin of renal nerve activity. This required maintaining dogs in good physiological condition under anaesthesia for extended periods (up to 72 hours) while waiting for the active transport of horseradish peroxidase to the cell bodies of sympathetic preganglionic neurones within the spinal cord.

The histochemical and histological procedures were all performed by me; by using the very sensitive tetramethylbenzidine technique I was able to follow the intraspinal course of axons and dendrites of labelled neurones more extensively than had been demonstrated before. Several aspects of this work have been presented to anatomical and physiological societies and the completed work has been published as a full paper. It was concluded that most preganglionic neurones contributing activity to the renal nerves were located in spinal cord segments T10, 11 and 12.

b) The aim of the main study was to define specifically the types of responses and the anatomical distribution in the medulla oblongata and spinal cord, of neurones whose activity was altered by left atrial receptor stimulation. I made electrophysiological recordings of the spontaneous activity of single neurones in the medulla oblongata and spinal cord of the dog while stimulating atrial receptors. This complex preparation involving cardiovascular and neurophysiological techniques was demonstrated to the Physiological Society. I concluded that inhibition as well as excitation of neuronal activity by atrial stretch receptor stimulation occurred not only in the area of spinal cord responsible for renal nerve activity but also in the medulla oblongata.

c) My electrophysiological experiments required detailed anatomical marking of electrophysiological recording sites. These sites were mapped out precisely by iontophoresis of dye from the tip of a new gold sputter-coated micropipette which I developed for this purpose. Details of electrode manufacture have been demonstrated to the Physiological Society, and the method has also been published as a paper.

As well as working on my own projects I collaborated with a colleague, Dr J.A.Bennett, in his work on cat medulla oblongata, making electrophysiological recordings of single neurones in the brain stem of the cat that were excited or inhibited by electrical stimulation of one or more different branches of the vagus nerve.

My thesis was completed during my appointment as Senior Registrar in Anaesthesia in the Hammersmith Hospital and I was awarded the degree of Ph.D. from the University of Leeds in September 1984.

### Independent Research

I always intended to use my research training and experience gained in the Department of Cardiovascular Studies in the pursuance of a career in research. In particular I have always felt that much is to be gained by the application of basic science disciplines to problems in anaesthesia and pain medicine. I realised that the neurophysiological and anatomical techniques that I had learned during my Ph.D. training would be useful in research directed towards the understanding of the handling of nociceptive information by the dorsal horn of the spinal cord. Such knowledge would be useful in the design of treatments for both postoperative and persistent pain states.

Upon taking up my appointment in Leeds my brief from Professor McDowall was to become an independent researcher working in the new and then uncommissioned anaesthetic department laboratory in the new Medical and Dental School in Leeds. The new laboratory was equipped and I was able to perform acute and recovery experiments in the fields of neurophysiology, neuropharmacology, neuroanatomy and cardiovascular physiology on a variety of animals.

My laboratory research interests have been in the following areas.

- a) Cardiovascular studies: to define the mechanisms by which anaesthetic drugs affect the circulation. Central to these studies is the use of laboratory preparations that divorce the cardiovascular effects mediated by depression of central sympathetic nervous system outflow by anaesthetic drugs and their direct action on the heart and blood vessels. From studies on the dog and on isolated tissues, we have concluded that direct venodilator and arteriolar vasodilator effects contribute to the greater cardiovascular depression of some intravenous anaesthetic agents.
- b) Spinally administered analgesics: to define the effect of potential analgesic substances given spinally and to define their basic mechanisms of action. The work has involved the development of an animal model that allows the demonstration of segmental analgesic effects following intrathecally administered drugs, as well as neurophysiological and neuropharmacological investigations, on neuronal activity in the spinal cord.

I have also performed investigations in humans in the operating theatre and in the pain clinic. Thus it is possible to investigate the antinociceptive actions of a drug in the laboratory using several different approaches leading to a fundamental understanding of the mechanisms involved in those actions, and subsequently to investigate the clinical usefulness of the drug. The drugs investigated so far include opioids and benzodiazepines (including midazolam) as well as steroid anaesthetics, propofol, 5HT and cholinergic receptor and adrenoceptor agonists. Results from this research programme have been presented to the Anaesthetic Research Society on several occasions, the Pharmacological Society, the European Academy of Anaesthesiology, the British Opioid Colloquium and the International Association for the Study of Pain.

The work on intrathecal midazolam involved collaboration with Dr J.M.Serrao after her appointment as Lecturer (Honorary Senior Registrar) in the University Department of Anaesthesia. After our initial experiments, Dr Serrao registered for the degree of Ph.D. with the University of Leeds. The subject matter for the thesis was to be the analgesic effects of spinally applied substances, in particular, the benzodiazepines. The work involved neuropharmacological experiments in the laboratory and clinical experiments in the operating theatre and pain relief clinic. Collaboration with the Department of Pharmacology in the University of Leeds led to the formation of the Spinal Analgesia Group.

Since then much work was performed while I was in Leeds, not only with Dr Serrao, but also with other postgraduates, Ph.D. students and eight undergraduates during the last four years of my

appointment in Leeds. I supervised undergraduate pharmacology students in their final year research projects; in 1991 four of these students worked on various aspects of spinal antinociceptive mechanisms.

#### *Other Clinical Research*

I also collaborated with the University Department of Medicine in Leeds on two projects investigating the effects of the plasma expander, hydroxyethyl starch, and the serum protease inhibitor, aprotinin, on haemostatic mechanisms and post-operative blood loss. The latter study was a large double blind study of haemostasis and post-operative blood loss in patients having repeat surgery for replacement of heart valves. The haemostatic effect of aprotinin is potentially an important economic factor as well as increasing the safety of this highly complex operative procedure. The results have now been published. Aprotinin does cause a statistically significant reduction in postoperative blood loss but this may be clinically and economically unimportant. The results indicate that a full cost/benefit and risk analysis of the causes of operative blood loss and its treatment is indicated.

## PUBLICATIONS

### Papers published:

Bennett JA, Goodchild CS, Kidd, C, McWilliam PN. The excitation of neurones in the brain stem by vagal afferent fibres from the heart and lungs. *Journal of Physiology* 369: 1-15; 1985

Bennett JA, Goodchild CS, Kidd, C, McWilliam PN. The location and characteristics of sympathetic preganglionic neurones in the lower thoracic spinal cord of the dog and cat. *Quarterly Journal of Experimental Physiology* 71: 79-92; 1986

Goodchild CS, Crane R, Bennett JA, Ford TW, Kidd C, McWilliam PN. A sputtered gold microelectrode in combination with a multibarrelled micropipette: a low impedance extracellular recording electrode with the facility for iontophoresis. *Electroencephalography and Clinical Neurophysiology* 67: 91-94; 1987

Goodchild CS, Noble J. The effects of intrathecal midazolam on sympathetic nervous system reflexes in man - a pilot study. *British Journal of Clinical Pharmacology* 23: 273-285; 1987

Goodchild CS, Serrao JM. Intrathecal midazolam in the rat: evidence for spinally-mediated analgesia. *British Journal of Anaesthesia* 59: 1563-1570; 1987

Cripps TP, Goodchild CS. Intrathecal midazolam and the stress response to upper abdominal surgery: adrenocortical, glycaemic and analgesic effects. *Clinical Journal of Pain* 4: 125-128; 1988

Goodchild CS. Post-operative recovery rooms: staffing and facilities in three regions in the United Kingdom. *Anaesthesia* 43: 829-832; 1988

Bennett JA, Goodchild CS, Kidd, C, McWilliam PN. Inhibition of brain stem neuronal activity by cardiac and pulmonary vagal afferent fibres in the cat. *Quarterly Journal of Experimental Physiology* 73: 959-972; 1988

Bell DB, Goodchild CS. Hypertrophic obstructive cardiomyopathy in combination with a prolapsed mitral valve. Anaesthesia for surgical correction with propofol. *Anaesthesia for surgical correction with propofol. Anaesthesia* 44: 404-411; 1989

Serrao JM, Stubbs SC, Goodchild CS, Gent JP. Intrathecal midazolam and fentanyl in the rat: evidence for different spinal antinociceptive effects. *Anesthesiology* 70: 780-786; 1989

Goodchild CS, Serrao JM. Cardiovascular effects of propofol in anaesthetized dog. *British Journal of Anaesthesia* 63: 87-92; 1989

Weir DL, Graham DI, Goodchild CS. Propofol: Effects on indices of cerebral ischaemia. *Journal of Neurological Anesthesiology* 1989, Vol I, pt III.

Bentley GN, Gent JP, Goodchild CS. Vascular effects of propofol: smooth muscle relaxation in isolated veins and arteries. *Journal of Pharmacy and Pharmacology* 41: 797-798; 1989

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### **Theses of Past Students of Monash University Dept Anaesthesia**

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- Fleming, Julia. Spinal cord GABA<sub>A</sub> and benzodiazepine receptors modulating nociception. PhD 2000
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### **Patents**

- Australia 698746 New use of pregnane-diones as analgesics Goodchild
- Australia 735092 New use of pregnane-diones as analgesics Goodchild
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### **PRESENTATIONS DURING CURRENT APPOINTMENT**

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XII International Congress of Pharmacology, Montreal, 24-29 July, 1994. Spinal Antinociceptive actions of ORG 20380, a water soluble steroid anaesthetic, CS Goodchild.

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An oblique saggital spinal cord slice preparation for the study of nociceptive transmission in the adult rat. 9<sup>th</sup> World Congress on Pain, Vienna Austria 22-27 Aug 1999. AJ Penberthy, CS Goodchild

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Anaesthetic Department Alfred Hospital, 20 May, 1993. Neurosteroids. CS Goodchild.

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Annual Clinical Meeting, Mercy Private Hospital, 6 October, 1993. Pain and its management, CS Goodchild.

Pharmacology Department, Monash University, 14 October, 1993. GABA – potential for neuroanalgesic development, CS Goodchild.

Anaesthetic Group, Wangaratta, 5-6 November, 1993. Lecture. CS Goodchild.

Prince Henry's Institute Medical Research, Melbourne, 12 November, 1993. Neurosteroids and analgesia, CS Goodchild.

Emergency Nurses Association Conference, Melbourne, 13 November, 1993. Analgesia on the move, CS Goodchild.

Dandenong Hospital/ICI, 9 December, 1993. Total anaesthesia for the high risk patient. CS Goodchild.

ICI Anaesthetic Meeting, ICI House Melbourne, 11 & 18 November 1993. Total intravenous anaesthesia. CS Goodchild.

Anaesthetic Department, Frankston Hospital, 20 May, 1994. Lecture. CS Goodchild.

Medical Research dinner, Hyatt 23 June, 1994. Lecture. CS Goodchild.

Anaesthetic Department, Box Hill Hospital 21 July, 1994. Lecture. CS Goodchild.

ICI, Caulfield Race Course, 30 August, 1994. Clinical application of anaesthetic maintenance with propofol. CS Goodchild.

Update for GPs, Monash University Medical School, 25 October, 1994. Pain management – practical guidelines for common painful conditions. CS Goodchild.

Anaesthetic Department Geelong, 28 February, 1995. TIVA with propofol. CS Goodchild.

Animals in Science Conference. Perspectives on their use, care and welfare. Monash University Victoria, 19-21 April 1995. Analgesic effects of veterinary anaesthetic drugs. 66P. CS Goodchild.

Peter MacCallum Cancer Institute Grand Round, 22 May 1995. Rats to man in one jump. CS Goodchild.

Anaesthetic Group, Wangaratta, 3 November, 1995. Lecture. CS Goodchild.

Glaxo Anaesthetic Meeting, Marchettis, Melbourne. 14 November, 1996. Lecture. CS Goodchild.

Post Operative Pain Management Symposium, Hyatt, Melbourne, 3 March, 1997 CS Goodchild.

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Anaesthetic Academic Meeting, Southern Health Care Network, 14 March, 1998. Post marketing surveillance studies Strom, CS Goodchild.

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The Victorian Society of Post Anaesthesia and Anaesthesia Nurses. Melbourne, 19-20 June 1998. A simple strategy (strategy-Dr) to identify randomised trials in post operative research. T Chow, CS Goodchild.

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Clinical meeting ASTRA 22 July 1998 Adelaide SA. Prevention of post operative chronic pain -- the role of the surgeon and anaesthetist. CS Goodchild

Annual Clinical Anaesthetic Meeting Valley Private Hospital Melbourne. New Directions in perioperative pain control 10 September 1998 CS Goodchild.

Peninsula and Southern Health Care Network Academic Meeting, 18 September, 1998. Intrathecal Infusion. CS Goodchild.

Anaesthetic Meeting 21 September 1998. St Vincents Hospital Melbourne. Advantages of ketamine for post operative pain relief. CS Goodchild

Surgical Audit and Forum Program. March 16 1999. Monash Medical Centre. Pain Management. CS Goodchild.

Monash / Mercy Anaesthesia Meeting. 10 April 1999 Monash Medical Centre. Analgesia Review -- New Advances. CS Goodchild

Monash Training Day 1<sup>st</sup> Part and HMO Teaching. 22 June 1999 Monash Medical Centre. Pain --

Applying the Basic Sciences. CS Goodchild.

Pain Management Day, 26 July 1999 Cabrini Hospital. Pain management lecture CS Goodchild

Cystic Fibrosis Seminar, 27 July 1999 Monash Medical Centre Chronic Pain in cystic fibrosis. CS Goodchild.

Monash Training Scheme 2<sup>nd</sup> Part Registrar Tutorials, July 28 1999 Monash Medical Centre. Pain. CS Goodchild.

Surgery for Lawyers "Advanced symposium on controversy", 11 November 1999. Multidisciplinary pain management: needles and pins. CS Goodchild

Lecture – Grad Dip Nursing (Perioperative) - Pain Management. April 11, 2000 Deakin University. CS Goodchild

Neurosteroids in Pain, St Vincents Hospital, Anaesthetic Department meeting, 14 March 2001 CS Goodchild

Pain Lecture, The University of Queensland School of Pharmacy 3 May 2001 CS Goodchild

Neurosteroid Analgesia, 29 August 2001 Palliative Medicine Committee (subcommittee of Victorian Cooperative Oncology Group), Anti-Cancer Council of Victoria. CS Goodchild

Lecture, Victorian Neuroscience Group 1 May 2002 CS Goodchild

Educational Lecture, Valley and South Eastern Private Hospital 7 May 2002 CS Goodchild

Pain lecture - ANZCA primary tutorial 27 May 2002 CS Goodchild

CSL National Cycle Meeting, Hamilton Island 4-8 Aug 2002 L Winter

Neurosciences Victoria Drugs targeting spinal cord GABA<sub>A</sub> receptors: the magic bullet has arrived. 11 August 2003 CS Goodchild